

**【CLAIMS】**

**【Claim 1】**

A blood pump actuator to generate a driving force for  
5 driving a blood pump, the blood pump actuator comprising:

a motor unit having a stator and a rotor, and rotating  
to generate a rotating force;

a cam unit to convert the rotating motion of the motor  
unit into a rectilinear reciprocating motion; and

10 a bellows unit comprising a bellows, which is  
expandable and contractible and contains a fluid therein, and  
an upper bellows plate and a lower bellows plate respectively  
attached to the upper and lower ends of the bellows,

wherein the lower bellows plate moves upwards and  
15 downwards in a vertical direction according to the rectilinear  
reciprocating motion of the cam unit engaging with the lower  
bellows plate, and the bellows repeatedly expands and contracts  
according to the vertical movement of the lower bellows plate.

20 **【Claim 2】**

The blood pump actuator according to claim 1, wherein  
the cam unit comprises:

a cam having a cam guide continuously formed around an  
outer circumferential surface of a cylindrical body of the cam;

25 a cam cover mounted to an upper end of the cam; and

a cam gear mounted to an end of the cam cover such that the cam gear is concentric with the cam and receives the rotating force of the motor unit.

5   **【Claim 3】**

The blood pump actuator according to claim 2, wherein the bellows unit is placed on the upper end of the cam unit, and the lower bellows plate comprises a lower bellows plate extension part which extends, at an edge of the lower bellows  
10 plate, towards the cam unit, is perpendicular to the lower bellows plate, is spaced apart from the cam unit, and is placed outside the cam unit, wherein the lower bellows plate extension part comprises a cam guide engagement part provided on an inner surface thereof to engage with the cam guide.

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**【Claim 4】**

The blood pump actuator according to claim 3, wherein the cam guide comprises a protruding cam guide, while the cam guide engagement part comprises a depressed cam guide  
20 engagement part.

**【Claim 5】**

The blood pump actuator according to claim 3, wherein the cam guide comprises a depressed cam guide, while the cam

guide engagement part comprises a protruding cam guide engagement part.

**【Claim 6】**

5           The blood pump actuator according to claim 3, wherein the cam guide has a sine curve shape.

**【Claim 7】**

          The blood pump actuator according to claim 3, wherein  
10 the cam guide has an asymmetrical curve shape.

**【Claim 8】**

          The blood pump actuator according to claim 3, wherein the cam guide has a stepped shape.

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**【Claim 9】**

          The blood pump actuator according to claim 3, wherein the cam guide has a linear function curve shape having a peak and a trough.

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**【Claim 10】**

          The blood pump actuator according to claim 3, wherein the lower bellows plate extension part is continuously formed around an outer circumferential surface of the lower bellows  
25 plate.

**【Claim 11】**

The blood pump actuator according to claim 3, wherein the lower bellows plate extension part is discontinuously  
5 formed around an outer circumferential surface of the lower bellows plate.

**【Claim 12】**

The blood pump actuator according to claim 11, wherein  
10 the lower bellows plate comprises two or more discontinuous lower bellows plate extension parts which are arranged at respective positions dividing the lower bellows plate into even sectors.

15 **【Claim 13】**

The blood pump actuator according to claim 1, wherein the motor unit comprises a housing at a lower part thereof and is placed below the bellows unit, with a bellows guide extension part provided on an edge of the lower bellows plate  
20 and extending toward the cam unit, while the housing of the motor unit is provided with a bellows guide to guide the bellows guide extension part.

**【Claim 14】**

The blood pump actuator according to claim 13, wherein the bellows guide extension part comprises a rod-shaped part, while the bellows guide comprises a linear bushing to receive the bellows guide extension part therein.

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**【Claim 15】**

The blood pump actuator according to claim 1, further comprising: a reduction gear mechanism placed between the motor unit and the cam unit.

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**【Claim 16】**

The blood pump actuator according to claim 15, wherein the reduction gear mechanism comprises a planetary gear mechanism.

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**【Claim 17】**

The blood pump actuator according to claim 16, wherein the planetary gear mechanism comprises: a sun gear having a gear part around an outer circumferential surface thereof; a carrier placed at a predetermined height different from a height of the gear part of the sun gear; at least two or more planetary gears mounted on a surface of the carrier and engaging with the gear part of the sun gear; and a ring gear having a gear part around an inner circumferential surface thereof and engaging with the planetary gears, wherein the

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carrier is mounted to an inner surface of the rotor, the sun gear is concentric with the cam unit, and the ring gear is integrally formed with the cam gear.

5   **【Claim 18】**

The blood pump actuator according to claim 1, further comprising: a pressure regulating unit to regulate pressure in the bellows.

10   **【Claim 19】**

The blood pump actuator according to claim 18, wherein the pressure regulating unit comprises:

15   a pressure gauge connected to the bellows through a pressure connection part and measuring pressure of the fluid in the bellows;

a fluid pump connected to the pressure connection part and supplying or discharging the fluid to or from the bellows;

20   control valves respectively placed between the bellows and the pressure gauge and between the pressure gauge and the fluid pump and controlling the flow of the fluid; and

a pressure control unit to control both the control valves and the fluid pump in response to pressure in the bellows measured by the pressure gauge, thus maintaining inner pressure of the bellows within a predetermined pressure range.

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**【Claim 20】**

A blood pump system, comprising:

the blood pump actuator of claim 1; and

a diaphragm which communicates with the bellows of the  
5 blood pump actuator through a connection part and is deformed  
according to changes in volume of the bellows, thus pumping  
blood from the blood pump system to a desired place in the body  
of a patient according to the deformation of the diaphragm.